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The match between students' lesson perceptions and preferences: relations with student characteristics and the importance of motivation

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Background: The match between students' perceptions of a learning environment and their preferences about its design influences students' learning behaviour and by consequence the effectiveness of education. Therefore, the students' perspective deserves a more prominent place in the educational design process. Having an adequate picture of the match between students' perceptions and preferences is needed for teachers/educational designers to account for students' perspectives while designing education. As perception–preference match is likely to differ between students, establishing correlates to it would provide valuable information. Students' perceptions are known to relate to several student characteristics; this study extends our understanding to its relations with perception–preference match.
Purpose: This study aims to investigate the degree to which students' perceptions of lessons match with their preferences about different characteristics of modern education. Additionally, it is aimed to determine the most prominent relationships between perception–preference match and learning-related student characteristics.
Sample: The sample consisted of 1146 10th-grade high school students (mean age = 16 years) from five secondary schools in the Netherlands. As data collection took place during normal school hours, the response rate was 100%, comprising all students that were at school on the day of data collection.
Design and methods: To measure students' perceptions of the lessons and their preferences about its instructional design, students completed the Inventory of Perceived Study Environment Extended, being composed of eight scales about central characteristics of modern education. The Inventory of Learning Styles was administered to measure learning-related student characteristics: cognitive processing strategies, regulation strategies, motivational orientations, conceptions about learning and affective processing strategies. To answer the research questions, paired *t*-tests and multiple regression analyses were conducted.
Results: Findings showed low perception–preference matches on fascinating contents, clarity of goals and student autonomy. Students preferred these characteristics being more represented in their lessons than they actually perceived them. Perception–preference match was predominantly related to students' motivation and affective state: a personally interested motivational orientation related to better perception–preference match, whereas motivation/concentration problems related to worse matches. These relations did not give

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indications about causality, but based on the literature a bidirectional relation is supposed.
Conclusion: This study shows that students' perception–preference match gives clear indications for which aspects of lessons could be improved. As students consider almost all characteristics of modern education as desirable, meeting students' preferences could contribute to more effective education. Additionally, the perception–preference match relates to students' motivation and affective strategies. Improving education by accounting for the match between students' perceptions and preferences of education is likely to improve motivation as well as having a significant effect on the quality of education.

Keywords: student experience; instructional design; alignment; motivation; user satisfaction

Introduction

Educational designers and teachers focus lots of effort on designing instructional methods that provide students optimal conditions to learn. However, only their own knowledge and professional experiences are incorporated. Students are usually not involved in the educational design process (Cook-Sather 2001), and designers and teachers have only limited insight in students' views on it (e.g. Kershner and Pointon 2000). Instruction that is meant to be appropriate for students will be most effective if it is actually perceived by them as appropriate (Elen and Lowyck 1999; Norman 1986, 1988).Therefore, the main goal of the current study is to investigate the degree to which student perceptions of their instruction/lessons match with their preferences. This question deserves a more prominent place in the educational design process, because it is known that students' perceptions of instruction are very important for its effectiveness in terms of learning results (Doyle 1977; Elen and Lowyck 1999; Entwistle and Tait 1990).

The first goal of this study is to investigate the degree of correspondence between students' perceptions and their preferences (i.e. perception–preference match) with respect to different characteristics of modern education, like the degree of student autonomy or the clarity of learning goals. Perception–preference match, however, is an individual adjustment of the degree to which instruction matches one's needs and preferences and this is likely to vary depending on students' characteristics (Eccles et al. 1993). Therefore, the second goal of this study is to learn more about relationships between perception–preference match and student characteristics.

Educational design and the student's perspective

According to the Combination-Of-Perspective model, information on how education is experienced by students should provide teachers and educational designers with feedback on their work (Könings, Brand-Gruwel, and Van Merriënboer 2005). It provides teachers with input they can use to optimise their lessons and should ultimately help designers to incorporate this user (i.e. student) knowledge in their instructional designs. Markopoulos and Bekker (2003) even argued that an educational design should be driven by knowledge of the students, and that they should not only be involved as users, testers and informants but as real design partners. It is of great value to determine explicitly how students perceive their education, especially because student interpretations of the environment are not easily predictable for teachers and designers (Donaldson 1978; Kershner and Pointon 2000).

Although the importance of students' views is acknowledged (Burke 2007), it is not yet incorporated in designing daily teaching practices (Cook-Sather 2001). It is important to change this way of working, since research pointed out that not the characteristics of the instruction itself, but foremost students' perceptions of the instruction determine the nature and quality of their learning processes and, eventually, the effectiveness of instruction (Elen and Lowyck 1999; Entwistle and Tait 1990). If students' perceptions do not match with the original intentions of the teacher, the instruction is likely not to reach its goals. This fits within the cognitive mediational tradition (Doyle 1977), which stresses that instructional interventions do not directly influence student learning. The learning effects are mediated by students' perceptions and interpretations of the learning environment. Additionally, students use only those instructional elements that are in congruence with their learning preferences and match well with their habitual way of learning (Vermetten, Vermunt, and Lodewijks 2002). By consequence, more knowledge about the match between students' perceptions and preferences on instruction is of utmost importance. If there is a bad match, students are likely to choose their own ways of learning, instead of behaving in agreement with the instructional design (Vermetten, Vermunt, and Lodewijks 2002). Additionally, learning arrangements that do not match students' needs are likely to have negative consequences on their motivation and engagement (Eccles et al. 1993), cause problems such as poor grades, misconduct and poor mental health (Roeser, Eccles, and Sameroff 2000), and it may end in students' disengagement and drop-out of school (Hijzen, Boekaerts, and Vedder 2007; Smyth and Fasoli 2007). Thus, both the students and the educational setting would benefit from an optimal match between students' needs or preferences and their perceptions of the offered instruction. As an implication, students' criticisms and points of dissatisfaction (i.e. bad perception–preference match) have to be taken very seriously.

Taken together, exploring the perception–preference match as experienced by the students could offer insight and feedback about what is really going on in the class. Therefore, our first research question focuses on the degree to which high school students' perceptions of their (innovative) learning environment match with their preferences about its instructional design.

Individual differences between students

When listening to students and investigating their perceptions, preferences and the match between both, it should be noticed that their reports are personal and varied, even if they follow the same lessons. This variation might be related to students' varying needs and expectations of a learning environment, and dissimilar values and norms used by the students to reflect on it (Levy, den Brok, Wubbels, and Brekelmans 2003). Another source of variation in student reports is provided by the result of an interaction between internal, learning-related characteristics (metacognitive instructional knowledge) and external, environment-related characteristics of the education as it is offered to students (Luyten, Lowyck, and Tuerlinckx 2001). Relevant internal learning-related variables described in the literature include: (1) cognitive processing strategies, (2) regulation strategies, (3) motivational orientations, (4) conceptions about learning, and (5) affective processing strategies (Vermunt and Vermetten 2004). For each of these learning-related student characteristics there is evidence for a relation with student perceptions and/or preferences.

First, students differ in their habits for using different kinds of *cognitive processing strategies* (i.e. cognitive activities that students use to process learning contents), which are likely to be related to the perceptions of the learning environment (e.g. Entwisle and Ramsden 1983; Entwistle and Tait 1990; Trigwell and Prosser 1991). Students who use deep processing strategies perceive the environment as more personalised, more strongly encouraging active learning and requiring more use of inquiry skills than students using stepwise processing strategies (Dart et al. 1999). Cognitive processing strategies are also related to preferences about the learning environment: students prefer an environment that supports their habitual way of learning (Entwistle and Tait 1990).

Second, the use of *regulation strategies* varies among students. In the way students regulate and steer their own learning process, they can regulate and manage their own learning process themselves, or rely heavily on the teacher or the environment for regulation, or even experience a complete lack of regulation during learning (Vermunt 1998). Students, who use self-regulatory strategies, actively manage their environment, adapt to it and change the environment to match better with their preferences and needs (Pintrich and Schauben 1992). These regulation strategies might lead to a better match between students' perceptions and preferences in a learning environment.

Third, students' *motivational orientations* (i.e. personal goals or motives students have for learning and going to school) seem relevant: changes in motivation can be explained by changing experiences of the lessons during a school year (Bong 2005). Learning environments that badly match with students' needs (i.e. bad perception–preference match) are likely to have negative consequences on students' motivation and engagement (e.g. Eccles et al. 1993), which in turns leads to inferior school performance (Schwinger, Steinmayr and Spinath 2009; Steinmayr and Spinath 2009). When students experience their educational needs (e.g. self-determination) as being neglected or frustrated, they even become vulnerable for dropping out of school (Hardre and Reeve 2003), which can be considered the most serious loss of motivation for learning.

Fourth, students' *conceptions about learning* and what constitutes learning relate to their perceptions of a learning environment (e.g. Dart et al. 2000). Conceptions influence perceptions as they can be seen as lenses through which people perceive and interpret the world (Pratt 1992). Tsai (2000) reported relationships between conceptions of knowledge and students' perceptions of instruction, as well as their preferences about how to learn: students with constructivist-oriented beliefs prefer environments in which knowledge construction has a prominent place. These students also perceive the environment differently, as they better understand the complexity of the offered environment and the learning opportunities they have in it (Campbell et al. 2001). Moreover, students' conceptions or epistemological beliefs indirectly influence learning approaches, as they are clearly related to the perceptions of the environment (Ozkal et al. 2009). Since both perceptions and preferences relate to conceptions about learning, perception–preference match may also relate to students' conceptions.

Fifth and last, *affective processing strategies* might also be related to students' perspectives on learning (Vermunt and Vermetten 2004). Affect refers to emotions and affective states, which may influence students' learning processes. Students' perceptions of teaching are related to the affective value of school: positive perceptions contribute to liking school and enthusiasm to participate in learning

activities (Ireson and Hallam 2005). Enthusiasm and positivism about school are only possible if the perceptions match with students' preferences and, thus, a relation between affective processing strategies and perception–preference match is hypothesised in our study.

In sum, various studies have shown that different learning-related student characteristics are related in some way to student perceptions and/or preferences. However, they have all been studied separately, not in coherence with each other and the relations with perception–preference match is underexposed. The current study investigates which learning-related student characteristics are related most strongly to perception–preference match. Based on the literature, it can be hypothesised that motivational orientation will be strongly related to perception–preference match (as these effects are described already in fair detail), but there are limited indications to define a hierarchy of importance of variables beforehand. For getting a clearer view, we will include all mentioned learning-related student characteristics in one study.

Taken together, the current study answers two research questions:

(1) To what degree do students' perceptions of their learning environment match with their preferences about different aspects of modern education? As modern education is based on principles of cognitive psychology and constructivism, the focus will be on students' perception–preference match with respect to several characteristics of modern education.
(2) How does the degree of match between students' perceptions and preferences relate to learning-related characteristics, in particular, cognitive processing strategies, regulation strategies, motivational orientations, conceptions about learning and affective processing strategies?

Method

Participants

The sample consisted of 1146 students of five schools for secondary education in the Netherlands. All 10th graders (mean age = 16.32 years, SD = 0.60) of these schools participated in the study. They were following either senior general secondary education (47.2%) or pre-university education (52.8%).

The participating schools in this study were located in the south of the Netherlands. The achievement level of the participating schools on the general examination indicates that they are representative of schools in the Netherlands, with one school at the senior general education level scoring greatly above the national average and two schools at the pre-university level scoring slightly above the average (Onderwijsinspectie [Dutch Inspection of Education] 2006).

Materials

The learning environment

The context of this study is a nationwide innovation in Dutch secondary education called the Second Phase (Ministerie van Onderwijs, Cultuur, en Wetenschap [Dutch Ministry of Education, Culture, and Science], n.d.; Stuurgroep Profiel Tweede Fase Voortgezet Onderwijs [Steering Committee for the Profile for the Second Stage of Secondary Education] 1995). The Second Phase requires students independently to

acquire skills and knowledge to better prepare them for higher professional education and university. Students learn in a self-directed way with ample opportunities for collaborative learning. There is more room for individual differences than in the traditional educational system, and teachers have to take these differences into account. The teacher's role is more like that of a coach and less like that of an instructor, which creates more opportunities for interaction between students and the teacher. The learning process is not only directed to knowledge acquisition but also to the selection and processing of the vast amounts of information available today. In addition, the coherence between knowledge and skills and the application of knowledge in subject-matter domains are emphasised. To summarise, the instructional design of the Second Phase includes all characteristics of a powerful learning environment.

Inventory of Perceived Study Environment Extended (IPSEE)

The IPSEE (Könings et al. 2008) measures students' perceptions of a particular learning environment and their preferences about its design. The perception–preference match pertains to the discrepancy between perception scores and preference scores. The IPSEE consists of 67 items. Thirty-one of these items originate from the Inventory of Perceived Study Environment (Wierstra et al. 1999; Picarelli et al. 2006). To measure the characteristics of powerful learning environments as described by Könings, Brand-Gruwel, and Van Merriënboer (2005) more completely, another 36 items were constructed.

The items of the IPSEE cover eight scales (Table 1) that are considered as central characteristics of modern education. The scale *fascinating contents* contains items about the extent to which the learning contents are interesting, challenging and personally relevant for the students. The scale *productive learning* indicates little emphasis on sole reproduction of learning contents but rather on an active process of making sense of the subject matter. The scale *integration* concerns integration of newly acquired knowledge with prior knowledge, of different subject matter domains, and of knowledge and skills. The scale *student autonomy* measures attention paid to students' self-directedness with regard to content of learning, way of learning and planning of time. The scale *interaction* incorporates collaboration with peers and interaction with the teacher. The scale *differentiation* inquires opportunities for students to choose and perform different learning tasks, solve problems in different ways, and use different learning materials. The scale *clarity of goals* includes items about the clarity of instructional goals and task demands. The scale *personalisation* measures the availability of support from teachers.

A sample item of each scale is included in Table 1. All items contain a statement about one of the characteristics of the learning environment and two questions, one related to the perceptions of a characteristic and one related to its desirability, as in the following example:

Students can decide for themselves how they wish to learn during the course.

(a) This happens.
(b) I would like this to happen.

The questions are answered on a 6-point scale, ranging from totally disagree (score = 1) to totally agree (score = 6). Scores on question A indicate students' perceptions and scores on question B indicate students' preferences. The discrepancy

Table 1. Internal consistencies and sample items for all scales of the Inventory of Perceived Study Environment Extended (IPSEE).

Scale	Sample item	Number of items	Cronbach's alpha coefficient		
			Perception	Preference	Perception–preference match
Fascinating contents	The assignments students have to make clearly relate to topics in everyday life.	9	0.85	0.77	0.81
Productive learning	The teacher expects the students to get the meaning of the concepts into their mind one by one	5	0.83	0.81	0.84
Integration	The teacher expects students to connect the various aspects of the subject matter on their own.	11	0.81	0.78	0.79
Student autonomy	I am given the opportunity to pursue my particular interest in the course.	15	0.85	0.84	0.88
Interaction	During classes, the subject matter is discussed with the students.	11	0.73	0.73	0.71
Differentiation	All students solve their assignments in the same way.	6	0.66	0.72	0.67
Clarity of goals	Students are informed what to expect of the examination.	4	0.81	0.72	0.79
Personalisation	Students can always rely on the teacher for help.	6	0.80	0.70	0.77

(i.e. absolute difference) between the scores on A and B refers to the perception–preference match with respect to the education offered (Wierstra et al. 1999). Discrepancy scores range from 0, indicating a good perception–preference match, to 5 what indicates an inferior perception–preference match. So, higher discrepancy scores refer to low match. For reaching conceptual congruence between the numerical scores and the meaning of the degree of match, discrepancy scores are recoded so that a score of 0 indicates lowest match (i.e. minimum) and the score of 5 refers to the highest match (i.e. maximum). Match scores are computed as 5 − discrepancy score.

Internal consistencies of the IPSEE scales are presented in Table 1. All Cronbach's alpha coefficients were above 0.70, except coefficients for the scale *differentiation*, which were above 0.65. They were all acceptable. Additional psychometric analyses have shown that there is no collinearity between the scales of the IPSEE (Könings et al. 2008).

Inventory of Learning Styles for Secondary Education (ILS-SE)

This questionnaire (Vermunt 1992; Vermunt, Bouhuijs, and Picarelli 2003) measures learning-related characteristics on the basis of the usual way of learning of secondary school students. The ILS-SE consists of 100 items divided in five clusters: (1) processing strategies (cognitive activities that students use to process learning contents), (2) regulation strategies (the way students regulate their own learning process), (3) motivational orientations (personal goals or motives students have for learning and going to school), (4) conceptions of learning (mental models about learning), and (5) affective processing strategies (emotional aspects of learning). Each of the five clusters contains several scales, which are presented in Table 2.

For each item, students rate the degree to which that particular statement corresponds to their own learning on a 5-point scale. Information about internal consistencies of the scales is included in Table 2; all Cronbach's alpha coefficients were acceptable. For four scales, the coefficients were above 0.60; for the other scales the coefficients were above 0.70. In addition to satisfactory internal consistencies, independency measures of the scales of ILS-SE have shown no statistical objections to considering the 16 scales separately (Könings et al. 2008; Picarelli et al. 2006).

Procedure

The participants filled out the IPSEE and the ILS-SE during regular school hours. Before completing the questionnaires, students were instructed about the goal and the contents of the questionnaires and about the scoring method. The IPSEE took between 30 and 40 minutes to complete; the ILS-SE took between 20 and 30 minutes to complete. Students voluntarily participated in this study. As data collection took place during regular school hours, the response rate was 100%. Data collection was guided by the researcher, ensuring the students that their answers are handled confidentially and do not have any negative consequences to them.

Data analysis

For computing mean scores for each scale of the IPSEE, maximally 25% of missing values are accepted. So, if at least 75% of the items at scale level were filled out, these items were used to compute the mean score. Paired-samples *t*-tests were used to test

Table 2. Descriptions and internal consistencies of the scales of the Inventory of Learning Styles for Secondary Education (ILS-SE).

Cluster	Scale	Description of scale	Number of items	Cronbach's alpha
Processing strategies	Deep processing	Relating and structuring knowledge elements and critical processing of information	12	0.84
	Stepwise processing	Memorising, rehearsing, studying information in detail	8	0.80
Regulation strategies	Self-regulation	Regulation of the own learning process through activities like planning, monitoring, reflecting and own initiatives with respect to learning contents	8	0.71
	External regulation	Learning to be regulated by external sources, like books or teacher	6	0.66
	Lack of regulation	Difficulties with regulating learning and processing contents effectively	4	0.71
Motivational orientations	Personally interested	Learning because of interest in the learning contents and the wish to develop oneself	4	0.67
	Certificate-oriented	Learning for passing tests, gaining high grades, and obtaining certificates	5	0.63
	Vocation-oriented	Learning for future study and professions	4	0.77
	Ambivalent	Doubtful, uncertain attitude toward own capacities and chosen courses	5	0.74
Conceptions of learning	Construction and use of knowledge	Learning as constructing one's own knowledge and using it by means of concretising and applying	8	0.81
	Intake of knowledge	Learning as taking in information, provided by education and memorising/reproducing it	4	0.64
	Cooperative learning	Preferring learning in cooperation with fellow students	3	0.76
	Stimulating education	Learning as a process continuously driven by teachers and/or textbooks	5	0.79
Affective processing strategies	Motivation/concentration problems	Problems with staying concentrated and motivated during learning, easily being distracted and sometimes showing postponing-behaviour	8	0.86
	Fear of failure	Experiencing stress during learning, especially in testing situations and having a negative self-image	8	0.87
	Keeping a good state of mind	Having a positive idea about own capacities, being self-confident and performing activities to stay motivated and concentrated	8	0.71

whether discrepancies between perceptions and preferences – indicating perception–preference match – were significant. Backward multiple regression analyses were conducted to investigate relations between perception–preference match scores and learning-related student characteristics. Separate analyses were computed for the match scores of each of the IPSEE scales, including the particular IPSEE scale as a dependent variable and all ILS-SE scales as independent variables. Because of the large sample size in this study and the number of conducted analyses (increasing risk of type I errors), in the following section only results are reported, which are significant at a level of $p < 0.01$.

Results

Perception–preference match, perceptions and preferences

Figure 1 presents the means of the perception and preference scores of the different scales of the IPSEE. By looking at the discrepancy between the perception bar and the preference bar, the perception–preference match can be deduced.

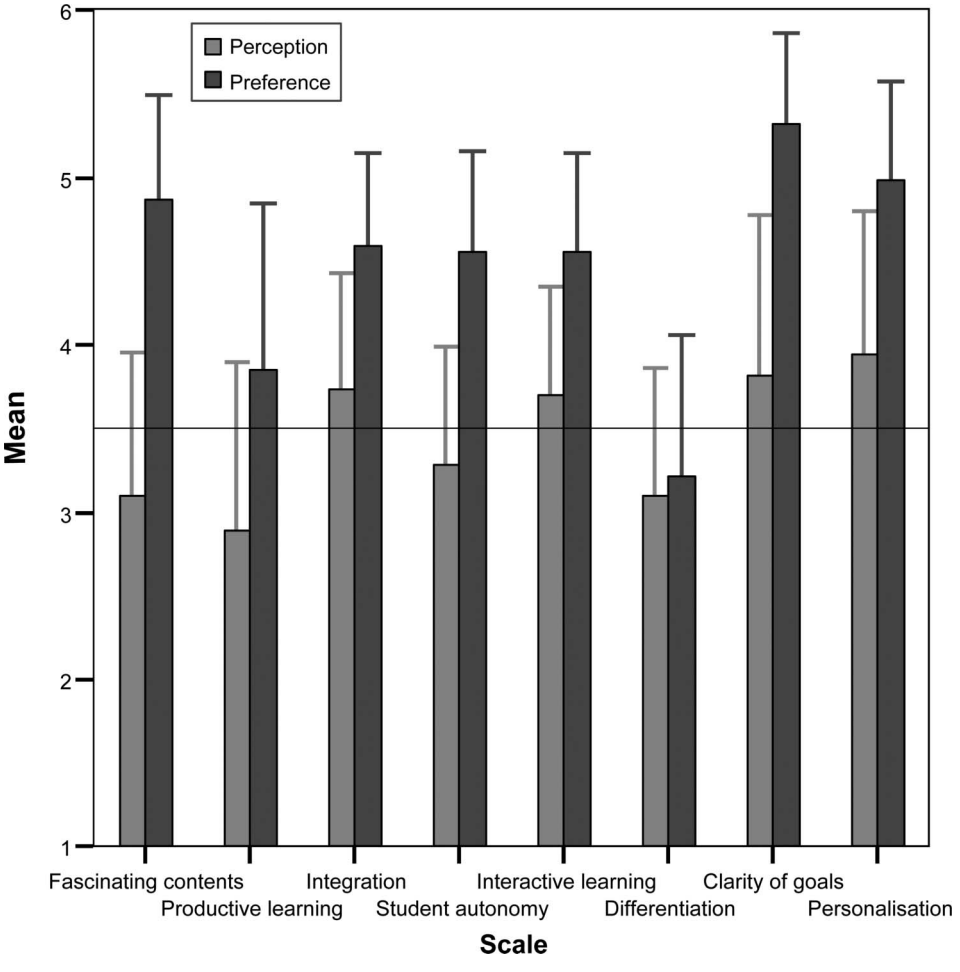

Figure 1. Mean scores and standard deviations of the perceived and preferred learning environment.

Table 3. Means and standard deviations of perception–preference match scores (ordered from low to high), perception, preference scores and results of *t*-tests comparing perceptions and preferences.

	Perception–preference match		Perception		Preference		t-tests$_{(\text{perception–preference})}$		
	Mean	SD	Mean	SD	Mean	SD	t	df	d
Fascinating contents	3.23	0.97	3.10	0.85	4.87	0.63	60.31	1118	2.37
Clarity of goals	3.47	1.04	3.82	0.96	5.32	0.55	46.81	1135	1.92
Student autonomy	3.67	0.89	3.29	0.71	4.56	0.59	44.82	1124	1.95
Personalisation	4.93	0.85	3.95	0.86	4.99	0.59	39.68	1131	1.41
Productive learning	3.77	0.99	2.87	1.00	3.85	0.99	25.67	1119	0.98
Interaction	4.10	0.64	3.70	0.65	4.56	0.58	41.60	1117	1.40
Integration	4.10	0.72	3.74	0.69	4.60	0.55	37.05	1082	1.38
Differentiation	4.36	0.65	3.10	0.76	3.22	0.85	4.09	1102	0.15

Note: Perception–preference match = 5 – discrepancy$_{\text{perception–preference}}$

The more both scores differ, the poorer the perception–preference match (e.g. fascinating contents). The more both scores correspond, the better the perception–preference match (e.g. integration). Although the size of the discrepancy differs among scales, paired *t*-tests showed that for all scales perception scores differed significantly from preference scores (Table 3). Effect sizes were large (*d* between 0.98 and 2.37) for all but one scale. There was only a small effect on the scale differentiation ($d = 0.15$). Perception scores were always lower than preference scores ($p < 0.01$), indicating that students prefer a more powerful environment than they actually perceive. Table 3 presents the descriptive statistics of the perception–preference match scores, together with the perception and preference scores. It can be seen from the table that perception–preference match was worst for fascinating contents, clarity of learning goals and student autonomy.

Furthermore, one-sample *t*-tests showed that on four of eight scales perception scores were significantly higher than the neutral score of 3.5 ($p < 0.01$), indicating that students perceived these characteristics of modern education to be present in their actual learning environment: integration, interaction, clarity of goals and personalisation as higher than neutral (*d*, respectively, 0.34, 0.30, 0.33 and 0.52). However, perception scores were lower than 3.5 on half of the measured aspects of the environment: fascinating contents, productive learning, student autonomy and differentiation (*d*, respectively, 0.47, 0.61, 0.30 and 0.53). Analyses on the preference scores showed that on seven of the eight scales preference scores were significantly higher than 3.5 ($p < 0.01$, *d* between 0.35 and 3.31), which means that students clearly preferred most of the characteristics of modern education. As an exception, the preference about differentiation was significantly lower than the neutral score ($p < 0.01$, $d = 0.33$).

Perception–preference match scores and learning-related student characteristics

Table 4 presents the results of the multiple regression analyses investigating the relations between perception–preference match scores and learning-related student characteristics, separately per IPSEE scale. Learning-related characteristics explained on average 8% of the variance in perception–preferences match on the different scales, ranging from 4% for the scale integration to 15% for fascinating contents. These percentages are rather low and beta weights are also relatively low, but from the table it can be seen that several student characteristics were frequently related to perception–preference match (i.e. on more than half of the IPSEE scales). These student characteristics will be described in more detail.

Perception–preference match scores were negatively related to displaying motivation/concentration problems. The more motivation/concentration problems were reported by students, the worse their perception–preference match scores for the scales fascinating contents, student autonomy, productive learning, interaction, integration and differentiation. In contrast, a personally interested motivational orientation was positively related to better perception–preference match on fascinating contents, clarity of goals, student autonomy, productive learning, personalisation and differentiation.

Strikingly, perception–preference match related most frequently to a motivational and an affective subscale: a personally interested motivational orientation contributes to better perception–preference match, whereas motivation/concentration problems contribute to inferior perception–preference match. Since match

Table 4. Significant regression weights ($p<0.01$) of variables predicting perception–preference match.

Dependent variable	R^2	Independent variable(s)	B	SE B	β
Fascinating contents	0.15	Motivation/concentration problems	−0.28	0.03	−0.24
		Personally interested	0.28	0.04	0.20
		Lack of regulation	−0.09	0.03	−0.08
Productive learning	0.09	Motivation/concentration problems	−0.20	0.04	−0.17
		Personally interested	0.25	0.04	0.18
		Keeping a good state of mind	−0.13	0.04	−0.09
Integration	0.04	Ambivalent	−0.11	0.03	−0.11
		Deep processing	−0.13	0.04	−0.11
		Motivation/concentration problems	−0.07	0.03	−0.09
Student autonomy	0.06	Motivation/concentration problems	−0.17	0.03	−0.16
		Personally interested	0.16	0.04	0.12
		Certificate-oriented	−0.21	0.05	−0.13
		Intake of knowledge	0.13	0.04	0.11
Interaction	0.07	Motivation/concentration problems	−0.11	0.02	−0.14
		Cooperative learning	−0.08	0.02	−0.11
		Lack of regulation	−0.08	0.02	−0.11
Differentiation	0.05	Motivation/concentration problems	−0.10	0.02	−0.13
		Deep processing	−0.16	0.03	−0.16
		Personally interested	0.08	0.03	0.08
Clarity of goals	0.09	Personally interested	0.26	0.04	0.17
		Lack of regulation	−0.21	0.04	−0.17
Personalisation	0.06	Lack of regulation	−0.18	0.03	−0.18
		Personally interested	0.14	0.04	0.12

scores are based on the discrepancy between perceptions and preferences, lower match scores of students with motivational and concentration problems could be because of lower perception scores, higher preference scores or a combination of both. Likewise, personally interested students could have better match scores because of higher perceptions, more moderate preferences or a combination of both. Therefore, we conducted some extra explorative (multiple regression) analyses on the relations between perception scores and learning-related student characteristics, and between the preference scores and students' characteristics.

Table 5 presents the results on the relations between perceptions and learning-related characteristics. Results on relations between preference scores and learning-related characteristics are presented in Table 6. The amount of explained variance was on average 14% for perceptions (ranging between 4 and 30%) and around 19% for preferences (between 8 and 35%). The variables of interest are printed in **bold** (personally interested) or underlined (motivation/concentration problems). It turned out that on the scales with positive relations between perception–preference match scores and personal interest (Table 4), also positive relations were found between perception scores and personal interest (for fascinating contents, student autonomy, clarity of goals, and personalisation; Table 5), but not for preference scores (Table 6). These findings indicate that higher perception–preference match scores of personally interested students are likely to originate from their more positive perceptions of the environment.

On the scales with negative relations between perception–preference match and motivation/concentration problems (Table 4), negative relations with perception scores were found on six scales (for fascinating contents, productive learning,

Table 5. Significant regression weights ($p < 0.01$) of variables predicting perceptions.

Dependent variable	R^2	Independent variable(s)	*B*	SE *B*	β
Fascinating contents	0.30	**Personally interested**	0.34	0.04	0.28
		Motivation/concentration problems	−0.25	0.03	−0.25
		Construction and use of knowledge	0.29	0.04	0.22
Productive learning	0.15	Stepwise processing	−0.27	0.04	−0.19
		Motivation/concentration problems	−0.17	0.04	−0.14
Integration	0.12	Construction and use of knowledge	0.20	0.04	0.18
		Vocation-oriented	0.13	0.03	0.14
		Motivation/concentration problems	−0.09	0.02	−0.11
		Personally interested	0.09	0.03	0.10
		External regulation	0.10	0.03	0.09
		Vocation-oriented	0.08	0.03	0.09
Student autonomy	0.06	**Personally interested**	0.12	0.03	0.12
		Motivation/concentration problems	−0.08	0.03	−0.10
		Construction and use of knowledge	0.11	0.04	0.10
Interaction	0.19	Cooperative learning	0.21	0.02	0.28
		Motivation/concentration problems	−0.12	0.02	−0.16
Differentiation	0.04	External regulation	−0.12	0.04	−0.10
Clarity of goals	0.12	Ambivalent	−0.16	0.04	−0.13
		Personally interested	0.20	0.04	0.15
		Lack of regulation	−0.14	0.04	−0.12
		External regulation	0.14	0.05	0.09
Personalisation	0.11	**Personally interested**	0.13	0.04	0.11
		External regulation	0.18	0.04	0.13
		Lack of regulation	−0.13	0.03	−0.13
		Motivation/concentration problems	−0.08	0.03	−0.08
		Construction and use of knowledge	0.12	0.04	0.09

integration, interaction, student autonomy and personalisation; Table 5) and a positive relation to preference scores on one scale (i.e. student autonomy; Table 6). On the vast majority of the scales, however, lower perception–preference match scores of students with motivation/concentration problems seem to be because of lower perception scores, rather than to higher preference scores.

Discussion and conclusions

This study aimed to provide insight in students' perception–preference match with respect to their learning environment. For the first research question – to what degree do students' perceptions of their learning environment correspond with their preferences on eight characteristics of modern education? – the results show that students are least satisfied with the degree to which contents were fascinating for them, the clarity of goals, and the offered opportunities for student autonomy. Students clearly prefer all studied characteristics of modern education (Könings, Brand-Gruwel, and Van Merriënboer 2005), including fascinating content, productive learning, integration, student autonomy, interactive learning, clarity of goals and personalisation. The only exception is differentiation, which is not a popular characteristic of education for students. The desirability of most aspect of modern education is a very positive outcome, as it indicates congruence between the aims of educational designers and students, which is essential for optimal functioning of a learning environment (Elen and Lowyck 1999).

Table 6. Significant regression weights ($p < 0.01$) of variables predicting preferences.

Dependent variable	R^2	Independent variable(s)	B	SE B	β
Fascinating contents	0.23	Construction and use of knowledge	0.27	0.03	0.27
		Deep processing	0.14	0.03	0.14
		Certificate-oriented	0.11	0.02	0.10
		Lack of regulation	0.08	0.02	0.10
		Keeping a good state of mind	0.08	0.03	0.08
Productive learning	0.21	Stepwise processing	−0.58	0.04	−0.41
		Intake of knowledge	−0.21	0.04	−0.16
		External regulation	0.13	0.05	0.08
Integration	0.29	Construction and use of knowledge	0.23	0.03	0.26
		Deep processing	0.14	0.03	0.15
		Vocation-oriented	0.07	0.02	0.10
		Stimulating education	0.07	0.02	0.10
		Keeping a good state of mind	0.07	0.02	0.08
		Cooperative learning	0.05	0.02	0.07
Student autonomy	0.08	Vocation-oriented	0.09	0.02	0.12
		Motivation/concentration problems	0.08	0.02	0.12
		Certificate-oriented	0.15	0.03	0.15
		Intake of knowledge	−0.10	0.03	−0.13
		Cooperative learning	0.08	0.02	0.11
		Fear of failure	−0.07	0.03	−0.08
Interaction	0.35	Cooperative learning	0.34	0.02	0.50
		Construction and use of knowledge	0.11	0.03	0.12
		Vocation-oriented	0.07	0.02	0.10
		Stepwise processing	0.07	0.02	0.08
Differentiation	0.13	Intake of knowledge	−0.24	0.03	−0.21
		Stepwise processing	−0.18	0.04	−0.15
		Construction and use of knowledge	0.14	0.04	0.11
		Vocation-oriented	−0.09	0.03	−0.08
Clarity of goals	0.10	Certificate-oriented	0.18	0.03	0.18
		External regulation	0.11	0.03	0.13
		Construction and use of knowledge	0.09	0.03	0.11
Personalisation	0.14	Construction and use of knowledge	0.16	0.03	0.17
		Certificate-oriented	0.13	0.03	0.13
		Stimulating education	0.08	0.02	0.10
		Keeping a good state of mind	0.10	0.03	0.11
		Cooperative learning	0.06	0.02	0.09

Students do not perceive all those aspects as being present in their education. They do perceive enough integration, interaction, clarity of goals and personalisation in their lessons. However, we found that they deny seeing, for example, lots of room for student autonomy. This finding could be because students do not always have an accurate perception of teachers' intentions in education (Broekkamp 2003). For instance, a teacher might have the intention to be clear about learning goals, but if students do not pick up relevant signals from the teacher this does not have the intended effects. Another possible explanation is that the instructional design of the lessons is not yet as modern and innovative as it could be (Könings, Brand-Gruwel, and Van Merriënboer 2007a). Teachers experience practical problems that make it difficult to use new instructional methods or their persistent approaches to teaching may hinder a complete implementation of innovations (Könings, Brand-Gruwel, and Van Merriënboer 2007a). In addition to perceiving too little room for autonomy,

students did not perceive fascinating contents, productive learning and differentiation. Together with high desirability of these aspects of education, these results show that students see ample room for improvement of the learning environment.

The second research question focused on how perception–preference match relates to learning-related student characteristics. The results show that motivational and affective subscales relate most clearly to perception–preference match: learning because of personal interest relates to a high perception–preference match, whereas reporting motivation/concentration problems is strongly linked to a low perception–preference match. Although earlier research has also shown relations with the other learning-related student characteristics, motivation and affective strategies appeared to be the most important variables in relation to perception–preference match (e.g. Eccles et al. 1993; Hardre and Reeve 2003; Ireson and Hallam 2005).

The found relations between variables, however, do not allow for any conclusions about the causal direction of found effects. Thus, do students become frustrated and lose motivation because of the education they follow? Or are they unhappy and do they attribute their negative feelings to school and the lessons? In daily life, a popular explanation is that because of puberty, many students do not value school because other things are more important for them. However, Roeser, Eccles, and Sameroff (2000) clearly distinguish between students for whom a low valuing of school is a marker for complex problems (e.g. poor motivation to learn, poor mental health, poor grades, affiliation with negative peers), and students who are just bored with their schooling. Other studies (Eccles et al. 1993) have also shown negative motivational consequences when the environment does not match well with the developmental needs and does not foster enough developmental growth. In a longitudinal study, Hardre and Reeve (2003) found that experiences in the classroom predict levels of motivation and students' intentions to persist or drop-out, indicating a causal relation from perception–preference match to motivation for learning.

Concluding, there is a genuine possibility that – at least part of – the students report motivation/concentration problems or low personal interest in learning because of characteristics of their current learning environment. This underlines the claim that education could be further improved by taking a closer look at students' perception–preference match. Because students prefer lessons that incorporate the characteristics of modern education more than currently perceived, their perspectives are worth to get a more prominent place in the design process of educational innovations.

A first theoretical implication is that motivational and affective student characteristics have to be considered as most important correlates to perception–preference match. Although other characteristics may be important as well, in this study personally interested motivational orientation and motivation/concentration problems were identified as most closely related to perception–preference match (in order, in a positive and a negative direction). Furthermore, students' perception–preference match was introduced as a dependent variable in our study. Wierstra et al. (1999) already described dissatisfaction as the discrepancy between perceptions and preferences, but it was not used before as a dependent variable. The current study shows that it is an important and informative additional construct when investigating students' perspectives on education.

A practical implication of this study is that, when listening to students' experiences and suggestions for improving lessons (e.g. Könings, van Zundert, Brand-Gruwel, and van Merriënboer 2007b), it is important to listen to *all* students. When a teacher asks students for their ideas – informally in the class situation or

during a meeting on collaboratively redesigning lessons – s/he has to talk with a representative sample of the students in his/her class. Both satisfied *and* dissatisfied students have to be consulted and involved in redesigning lessons. Students with a low perception–preferences match should certainly not be excluded from such a discourse because their criticisms are unwelcome. Probably, these students will benefit most from the opportunity to contribute to the (re)design of their education. By listening to all students – also the more dissatisfied ones – the communication between students and teachers is likely to improve, which positively affects the learning climate in the class (Seidel and Shavelson 2007) and, ultimately, the learning performances of students.

A limitation of the current study is that the explained amount of variance in the analyses was rather low and there may have been capitalisation of chance because of conducting eight regression analyses. However, while applying a significance level of $p < 0.01$, the results have still shown a clear pattern of variables that seem to be important. Another limitation is that students are asked to report on their perception–preference match with respect to the lessons in their current school year. This provides only general measures, independent of specific subject matter or teacher. Investigating the perception–preference match at a micro-level could be the focus of future research. Additionally, future investigations should give more clarity about the causal relations between perception–preference match and motivational and affective variables. It would be highly interesting to examine whether raising students' perception–preference match by educational redesign could improve motivation and decrease motivation/concentration problems. Another interesting point for future research starts with our finding of students' resistance for differentiation. As differentiating education to adapt to individual needs seems crucial for optimising the perception–preference match, underlying causes for this resistance have to be investigated.

To conclude, this study has shown students' perception–preference match can give clear indications for which aspects of lessons could be improved. As students consider almost all characteristics of modern education as desirable, meeting student preferences could contribute to more effective education. Additionally, the perception–preference match appeared clearly related to students' motivation and affective strategies. This study does not allow conclusions about the causal direction, but the available literature seems to indicate bidirectional relations. Improving education by accounting for the match between students' perceptions and preferences about education is thus likely to improve motivation besides a feasible effect on the quality of education. This supports our claim that teachers and designers need to take students' perception–preference match more seriously into account.

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